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EXAMINER	
KIM, DAVID S	

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2633	

DATE MAILED: 12/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/728,373	Applicant(s) YEE ET AL.
	Examiner David S. Kim	Art Unit 2633

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed on 10 April 2001 (Paper No. 4) fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but all the information referred to therein has not been considered. Examiner considered the information documents that were readily accessible, such as patents and journal documents that are available through online access. The other documents have not been considered; these documents are indicated by a lack of Examiner's initials next to the document listings. Should Applicant desire the consideration of these documents by Examiner, Applicant is advised to send a legible copy of each of these documents to the Office.

Drawings

2. Applicant's compliance with the objections to the drawings in the previous Office Action (mailed 22 March 2004) is noted and appreciated. The replacement drawing sheets were received on 24 August 2004. These replacement drawing sheets are approved. Accordingly, in view of the informal appearance of the drawings, a corresponding set of formal drawings is requested.

Specification

3. Applicant's compliance with the objections to the specification in the previous Office Action (mailed on 22 March 2004) is noted and appreciated. Accordingly, the previous objections are withdrawn.

Claim Objections

4. Applicant's compliance with the objections to claims 2 and 18 in the previous Office Action (mailed on 22 March 2004) is noted and appreciated. Additionally, Applicant provided

comments to clarify the previously objected claim language in claim 16. Accordingly, the previous objections are withdrawn.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. **Claims 1-9, 12, 15, 18-24, and 28** are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe (U.S. Patent No. 5,896,211) in view of Tsushima et al. (U.S. Patent No. 5,140,453).

Regarding claim 1, Watanabe discloses:

An optical communication system for communicating information comprising:

a receiver subsystem (Fig. 16) comprising:

an optical splitter (121) for splitting a composite optical signal having at least two subbands of information and at least one tone into at least two optical signals; and

at least two heterodyne receivers (portion of Fig. 16 after 121), each heterodyne receiver coupled to receive one of the optical signals from the optical splitter for recovering information from one of the subbands contained in the optical signal, each heterodyne receiver comprising:

a heterodyne detector (122-1...122-k) for mixing an optical local oscillator signal with the optical signal to produce an electrical signal which includes a frequency down-shifted version of the subband and the tone of the optical signal; and

a signal extractor (37-1...37-k) coupled to the heterodyne detector to produce a frequency component containing the information.

Watanabe does not expressly disclose:

said signal extractor coupled to the heterodyne detector *for mixing the frequency down-shifted subband with the frequency down-shifted tone* to produce a frequency component containing the information.

However, this mixing is a common demodulation technique used in coherent detection systems to extract an information signal from heterodyne-detected signals. Tsushima et al. teaches such mixing as part of a heterodyne detection device (e.g., note the squaring circuits in the demodulator of Fig. 4 as part of the device in Fig. 1). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to incorporate the heterodyne detection device of Tsushima et al. in the system of Watanabe. One of ordinary skill in the art would have been motivated to do this since Tsushima et al. directly addresses some concerns of Watanabe. That is, Watanabe teaches the need for addressing polarization fluctuation, an adverse effect in optical heterodyne reception (col. 13, l. 40-47). As a countermeasure, Watanabe lists several methods (col. 13, l. 49-51). One of the listed methods is a polarization diversity receiving method (col. 13, l. 49-50). Watanabe notes that this method is promising, but ceases further discussion about it due to costs stemming from a dual configuration (col. 13, l. 54-56). Tsushima et al. also recognizes the advantages of this method (col. 1, l. 17-30) and the costs of a dual configuration (col. 2, l. 7-26). Nonetheless, Tsushima et al. employs this

promising polarization diversity receiving method in a way that mitigates the dual configuration and cost concerns (col. 10, l. 3-26). Thus, Tsushima et al. addresses the concerns of Watanabe regarding the polarization diversity receiving method, enabling one of ordinary skill in the art to take advantage of the benefits of this polarization diversity receiving method, such as high sensitivity (col. 1, l. 15) and an improved signal-to-noise ratio (col. 1, l. 25-30).

Regarding claim 2, 4-5, and 8 Watanabe in view of Tsushima et al. does not expressly disclose:

The optical communications system of claim 1 wherein the optical splitter includes a separate splitter for separating each optical signal from the composite signal (claim 2), or

The optical communications system of claim 1 wherein the optical splitter includes a wavelength division demultiplexer for wavelength division demultiplexing the composite optical signal into the optical signals (claim 4), or

The optical communications system of claim 1 wherein the optical splitter includes a wavelength-selective optical power splitter for splitting the composite optical signal into optical signals, each optical signal including a different primary subband and attenuated other subbands, or

The optical communications system of claim 1 further comprising:

an optical wavelength filter coupled between the optical splitter and one of the heterodyne receivers.

However, these splitter limitations are all common and well known in the art, and both perform the same function of isolating a desired optical signal from a composite signal. Also, Watanabe in view of Tsushima et al. teaches an apparatus (optical branch unit and filters in Fig. 12) that performs the same general function. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to implement this isolating function according to the splitter limitations of claims 2, 4, 5, or 8. One of ordinary skill in the art would

have been motivated to do this since they offer common, additional options for implementing the same function, thus providing design and manufacturing flexibility. Moreover, these rejections are made in view of the recognition that these limitations do not constitute the thrust of the inventive concepts of Applicant's invention. Rather, they comprise common expedients of a well-known technical function in the art.

Regarding claim 3, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 wherein the optical splitter includes an optical power splitter (121 in Fig. 16) for splitting the composite optical signal into optical signals which are substantially the same in spectral shape (optical splitters conventionally split the input signal into multiple copies of the input signal, each copy having a reduced power level).

Regarding claim 6, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 wherein:

the electrical signal further comprises direct detection components (not shown but these components result from the mixing of the heterodyne detector in Fig. 1 of Tsushima et al.).

Watanabe in view of Tsushima et al. does not expressly disclose:

the frequency down-shifted version of the subband does not spectrally overlap with the direct detection components.

However, note that the frequency down-shifted version of the subband is filtered by a bandpass filter (Tsushima et al., bandpass filters in, e.g., Figs. 1 and 4). Also, note that the direct detection components that result from the mixing of the heterodyne detector in Fig. 1 of Tsushima et al. are generally unwanted components in standard heterodyne detection schemes. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to arrange the placement of the frequency down-shifter version of the subband so that it does not spectrally overlap with the direct detection components. One of ordinary skill in the art

would have been motivated to do this to avoid letting these undesired direct detection components pass through the bandpass filters along with a desired subband; these undesired direct detection components can introduce to detrimental interference and noise in the signal extractors (Watanabe, demodulators 37-1...37-k; Tsushima et al., e.g., Fig. 4).

Regarding claim 7, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 wherein the heterodyne detector comprises:

an optical combiner (Tsushima et al., optical combiner in Fig. 1) for combining the optical local oscillator signal and the optical signal; and

a square law detector (Tsushima et al., PIN photodiode 14 in Fig. 1, col. 5, lines 13-17; note that a PIN photodiode is a square law detector) disposed to receive the combined optical local oscillator signal and optical signal.

Regarding claim 9, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 wherein the tone for each optical signal is located at an optical carrier frequency for the corresponding subband (note the tones in the middle of each subband in Fig. 7C).

Regarding claim 12, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 wherein the frequency component includes a difference component (Tsushima et al., Fig. 3C, col. 6, lines 3-26).

Regarding claim 15, Watanabe in view of Tsushima et al. discloses:

The optical communications system of claim 1 further comprising:

a transmitter subsystem (transmitter side in Fig. 16) for generating the composite optical signal.

Regarding claims 18-24, claims 18, 19, 20, 21, 22, 23, and 24 are method claims that correspond to system claims 1, 2, 3, 4, 5, 7, and 9, respectively. Therefore, the recited means in system claims 1-5, 7, and 9 read on the corresponding steps in method claims 18-24.

Regarding claim 28, Watanabe et al. in view of Tsushima et al. discloses:

The method of claim 18 further comprising:

encoding (data signals D1...Dk in Fig. 16) the information in a composite optical signal (output from optical modulator 33 in Fig. 16); and

transmitting (modulator 33 and fiber 34 in Fig. 16) the composite optical signal across an optical fiber.

8. **Claims 10-11 and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of Tsushima et al. as applied to claims 1 and 18 above, and further in view of Hill et al. (U.S. Patent No. 5,546,190).

Regarding claim 10, Watanabe in view of Tsushima et al. does not expressly disclose:

The optical communications system of claim 1 wherein the tone for each optical signal includes a pilot tone located at a frequency other than at an optical carrier frequency for the corresponding subband.

Hill et al. teaches such a pilot tone (Figs. 2-5; col. 2, line 62 – col. 3, line 33; col. 4, lines 12-53; col. 5, lines 21-28; col. 5, line 59 – col. 6, line 11). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to use the pilot tone of Hill et al. in the system of Watanabe in view of Tsushima et al. One of ordinary skill in the art would have been motivated to do this to add the following features: simultaneously generate subcarrier frequencies for demodulation, the clock signal, and an automatic frequency control signal for the local oscillator (Hill et al., col. 3, lines 28-32).

Regarding claim 11, Watanabe in view of Tsushima et al. and Hill et al. discloses:

The optical communications system of claim 1 wherein at least two optical signals (Hill et al., note the multiple signals with the same pilot tone in Fig. 4) have tones at the same frequency.

Regarding claim 25, claim 25 is a method claim that corresponds to system claim 10. Therefore, the recited means in system claim 10 read on the corresponding steps in method claim 25.

9. **Claims 13-14, 16-17, 26-27, and 29-30** are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of Tsushima et al. as applied to claims 1, 15, 18, and 28 above, and further in view of Wong (U.S. Patent No. 6,058,227).

Regarding claim 13, Watanabe in view of Tsushima et al. does not expressly disclose:

The optical communications system of claim 1 wherein the receiver subsystem further comprises:

at least two FDM demultiplexers, each FDM demultiplexer coupled to receive the frequency component from one of the heterodyne receivers for FDM demultiplexing the frequency component into a plurality of electrical low-speed channels.

Wong discloses a transmission method that combines the principles of FDM and WDM (Wong, Fig. 3). This method includes FDM demultiplexers (Wong, power divider 77 and filters in RF Tuners 78 perform FDM demultiplexing). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to modify the system of Watanabe in view of Tsushima et al. to incorporate the combination of FDM and WDM, as taught in Wong. One of ordinary skill in the art would have been motivated to do this to increase the data transmission rates across a transmissions link and to expand the system. That is, the system of Watanabe in view of Tsushima et al. employs FDM. In view of Wong, this system could multiply data transmissions rates by transmitting on additional wavelengths, thus expanding the system (Wong, abstract, col. 4, lines 17-24).

Regarding claim 14, Watanabe in view of Tsushima et al. and Wong discloses:

The optical communications system of claim 13 wherein the receiver subsystem further comprises:

at least two QAM demodulation stages (Wong, Fig. 5), each QAM demodulation stage coupled to one of the FDM demultiplexers for QAM demodulating the electrical low-speed channels.

Regarding claim 16, Watanabe in view of Tsushima et al. does not expressly disclose:

The optical communications system of claim 15 wherein the transmitter subsystem comprises:

at least two transmitters, each for generating one of the optical signals, each transmitter using a different optical carrier frequency; and

an optical combiner coupled to the transmitters for optically combining the optical signals into the composite optical signal.

Wong discloses a transmission method that combines the principles of FDM and WDM (Wong, Fig. 3). This method includes multiple transmitters (Wong, Figs. 1-2), each for generating one of the optical signals, with different optical carrier frequencies and an optical combiner (Wong, WDM 24 in Fig. 1) coupled to the transmitters for optically combining the optical signals into the composite optical signal. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to modify the system of Watanabe in view of Tsushima et al. to incorporate the combination of FDM and WDM, as taught in Wong. One of ordinary skill in the art would have been motivated to do this to increase the data transmission rates across a transmissions link and to expand the system. That is, the system of Watanabe in view of Tsushima et al. employs FDM. In view of Wong, this system could multiply data transmissions rates by transmitting on additional wavelengths, thus expanding the system (Wong, abstract, col. 4, lines 17-24).

Regarding claim 17, Watanabe in view of Tsushima et al. and Wong discloses:

The optical communications system of claim 15 wherein the transmitter subsystem comprises:

at least two electrical transmitters (Watanabe, electrical transmitters inputting signals to multiplexer 71 in Fig. 16; Wong, transmitter subsystems 80 in Fig. 3) for generating electrical channels;

an FDM multiplexer (Watanabe, multiplexer 71 in Fig. 16; Wong, FDM in Fig. 3) coupled to the electrical transmitters for FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including the tones (Watanabe, subcarriers in Fig. 7C; Wong, carriers in the transmitter side in Fig. 3); and

an E/O converter (Watanabe, optical modulator 33 in Fig. 16; Wong, E/O converter in Fig. 3) coupled to the FDM multiplexer for converting the electrical high-speed channel into the composite optical signal.

Regarding claims 26-27 and 29-30, claims 26, 27, 29, and 30 are method claims that correspond to system claims 13, 14, 16, and 17, respectively. Therefore, the recited means in system claims 13-14 and 16-17 read on the corresponding steps in method claims 26-27 and 29-30.

10. **Claim 31** is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. in view of Tsushima et al. as applied to claim 28 above, and further in view of Ellis et al. ("Feedback control of a linearised Mach-Zehnder modulator for SCM applications") and Sargis et al. (U.S. Patent No. 5,596,436).

Regarding claim 31, Watanabe et al. in view of Tsushima et al. discloses:

The method of claim 28 wherein the step of encoding the information in a composite optical signal comprises:

receiving an optical carrier.

Watanabe in view of Tsushima et al. does not expressly disclose:

modulating the optical carrier with the information using a raised cosine modulation biased at a point substantially around a V_π point.

However, this modulating is well known in the art for Mach-Zehnder modulators. Watanabe does not expressly teach using a Mach-Zehnder modulator. Rather, Watanabe teaches direct modulation using a DFB laser to modulate an optical carrier (col. 4, l. 17-21). On the other hand, Ellis et al. teaches external modulation using a Mach-Zehnder modulator instead of direct modulation using a DFB laser (p. 33, middle of the paragraph under section I). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to employ external modulation using a Mach-Zehnder modulator instead of the direct modulation using the DFB laser of Watanabe in view of Tsushima et al. One of ordinary skill in the art would have been motivated to do this since external modulation using a Mach-Zehnder modulator provides advantages over direct modulation using a DFB laser, such as the lack of the nonlinear distortion caused by a frequency "chirp" that is generated by a directly modulated DFB laser (p. 33, middle of the paragraph under section I).

Employing a Mach-Zehnder modulator, one of ordinary skill in the art would inherently operate it using some Mach-Zehnder bias point (note the transfer function in Applicant's Fig. 4). The two most common bias points are around a quadrature point and a V_π point. Sargis et al. discloses the use of a Mach-Zehnder modulator biased around a V_π point (null bias point in col. 3, l. 40-46). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to modulate the optical carrier of Watanabe in view of Tsushima et al. and Ellis et al. with the information using a raised cosine modulation biased at a point substantially around a V_π point, as taught in Sargis et al. One of ordinary skill in the art would have been motivated to do this to suppress the optical carrier (col. 3, l. 40-46), thereby

preventing the optical carrier from dominating the transmission signal (in comparison with the smaller subcarriers/subbands) and leading to crosstalk at the receiving end (col. 3, l. 49-51).

Response to Arguments

11. Applicant's arguments filed on 24 August 2004, with respect to independent claim 1, have been considered but are moot in view of the new ground(s) of rejection. Note that the standing rejections depend on Watanabe as the primary reference.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Betts et al. is cited to show related teachings on carrier suppression and biasing Mach-Zehnder modulators.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Kim whose telephone number is 571-272-3033. The examiner can normally be reached on Mon.-Fri. 9 AM to 5 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571-272-3022. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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